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Question of Quarantine:

THE NATURE AND PREVENTION OF COMMUNICABLE ZYMOTIC DISEASES.

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THE QUESTION OF QUARANTINE.

If the old maxim, "*Salus Populi Suprema Lex*," were legally, as well as literally, applicable only to the bodily health of the public, and if, under this supreme law, hygienists were invested with absolute control over the persons and property of mankind at large, there could be no reasonable doubt of the potential efficacy of sanitary restrictions to abolish most, if not all, zymotic diseases. Whichsoever side we adopt in the controversy as to the etiology and *materies morbi* of the contagious disorders—whether we regard the essential virus as existing in minute particles of animal matter, or in vegetable microspores,—we cannot avoid the conclusion that the majority of them do not arise spontaneously at the present day, but depend for their propagation solely upon immediate or mediate communication between the healthy and the sick; and even admitting, for the sake of argument, that a few—such as diphtheria, erysipelas, possibly typhus and typhoid fever—may, under certain favoring conditions, originate *de novo*, these also are, at least ninety-nine times in a hundred, disseminated by the same means. Hence it follows, that if we could at will entirely arrest all human intercourse, we could at all events prevent the extension of such maladies, if not extinguish them altogether.

But, unfortunately, civilised humanity has acquired other interests which are practically of nearly as great importance as the limitation of contagious diseases, and therefore our profession has not been, nor is it likely ever to be, entrusted with the discretionary power requisite for the fullest exercise of its preventive functions. The improved hygienic conditions of our modern social life have rendered almost impossible any repetition of the exterminating ravages of the pandemics of former times, whilst the division of labor, which has been extended from individuals to nations, makes unrestricted commerce quite as essen-

tial a factor in the welfare of the community as a seemingly trifling variation, one way or the other, in the yearly bills of mortality. In dealing with the question of quarantine, therefore, we must consider not what might be done if all our theoretical views could be carried out, but what can practically be done with the facilities at our disposal.

In this connection, the sanitarian is called upon to answer two questions : first, whether epidemics can really be stayed by the intervention of quarantine ; and if so, secondly, what precautions are necessary, and what hindrances superfluous. The former of these questions may be answered unhesitatingly in the affirmative. Not only is the doctrine of the material nature of the various organic poisons sufficiently substantiated to warrant such an answer *à priori*, but experience has shown its truthfulness in many instances. Not to cite modern examples which have been brought to our very doors, the gradual extinction of the famous Eastern plague in Europe, exactly coinciding with the adoption of sanitary restrictions at different points, would alone almost suffice to demonstrate the efficiency of quarantines, when strictly enforced. The apparent failures of preventive medicine in this direction have undoubtedly been due to errors of administration ; neglect of the smallest detail vitiating, of course, the entire scheme.

Our general affirmative must, however, be to some extent qualified in its application to our own port. It is manifestly futile to detain vessels coming from infected points on our coast, while travel and traffic from the same places by land remain unimpeded ; it is almost as useless to stop the importation of smallpox through the Narrows, when any railway train or any ferry-boat may bring infected persons or fomites to our midst. The present epidemic of variola in Philadelphia has been attributed to the introduction of buffalo skins taken from Indian camps where the disease was raging nearly two years ago ; cholera once paid us a visit from Canada, via Albany, while we thought we were holding it at bay in our quarantine grounds ; yellow fever has made several journeys by land when its access by water was cut off ; and so of other maladies of this class. Furthermore, so long as other ports of entry along our shore allow easy ingress to all comers, rigorous rules in this harbor

are of little effect. A chain is no stronger than its weakest link, and one break in our *cordon sanitaire* renders the sound portions unavailing. For these reasons, it is to be wished that quarantine regulations could be made a subject of national legislation, and coupled with a uniform scheme of internal sanitary precautions. It can never be feasible to ascertain the history of every person and thing arriving at a great centre like this from all other parts of the continent; but under a comprehensive system of public hygiene, much might be done to prevent the exportation of disease from infected districts.

The weakness of our defences in the rear, however, is no reason for relaxing our vigilance at the front, and the intrinsic value of quarantines being granted, it remains to be determined in what manner, and to what extent, they should be enforced.

I need not remind you that the very word "quarantine," signifying a detention of forty days, carries us back to the fifteenth century, before much was known concerning the modes of transmission of communicable diseases—before even the now obsolete distinction between "contagious" and "infectious" maladies had been devised. Since then, our knowledge of epidemiology, although still far from perfect, has advanced far enough to warrant us in laying down somewhat more definite rules. The International Sanitary Conference held at Constantinople, in 1866, fixed upon ten days as the maximum period during which suspected persons should be kept under observation, provided that the vessel on which they arrive have a surgeon on board; and this period of surveillance is made to include the time occupied in the voyage. Thus, after a passage of only twenty-four hours, nine days of observation would be required, while if the vessel had been nine days at sea, a single day's detention would suffice. This, of course, is supposing that no cases of disease had occurred during the transit; and, moreover, although the deliberations of the Conference embraced preventive measures generally, its action was more particularly directed against the invasion of cholera. At the present day, more explicit instructions may be given, based upon a study of the respective periods of incubation and modes of communication of the different diseases which we seek to prevent.

In the first place, the "quarantine of observation" is infinite-

ly more important in the case of human beings than in that of the cargo of a suspected vessel. In the latter we have no period of incubation to watch for; the danger, if it exist at all, is a present danger, and may be overcome by prompt disinfection; but the introduction of steam navigation has complicated our sanitary problem, by so shortening the time of travel that it is quite possible for a steamer to make the trip from an infected to a healthy port in fewer days than are required for disease to manifest itself; she may show an apparently "clean bill of health" on her arrival, and yet some of her passengers may break out with a highly contagious disorder shortly after landing. In every instance, therefore, persons arriving from infected ports should be detained for a time corresponding with the stage of incubation of the suspected disease, dating, of course, from their last exposure to contagion. If this precaution were strictly observed, the disinfection of inanimate articles would take but little time, and the vessel and cargo might be rendered innocuous in a few hours. As it is, our quarantine laws (which seem to have been in great part drawn from the traditions of the Middle Ages) direct that all vessels arriving at the port of New York, "between the first day of April and the first day of November," from any infected place, "shall remain at quarantine thirty days after their arrival, and at least twenty days after their cargo shall have been discharged," whilst, with the single exception of passengers detained for vaccination, "no other well persons shall be detained in quarantine any longer than is necessary to secure cleanliness." Thus commerce is subjected to unnecessary restraint, while the graver source of danger to the public health is left unguarded.

In connection with the supervision of persons, the study of the incubation and transmissibility of the various organic poisons becomes of exceeding interest, since preventive medicine must adapt its efforts to the exigencies of each particular case. Some of these poisons can only be conveyed by direct contact; some must be swallowed to produce their effect; others are always inhaled; while a few may be contracted through more than one of these channels; and it is evident that our precautionary measures must be modified in accordance with the character of the virus which we have to encounter.

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Of the dozen communicable diseases caused by organic poisons, only four are by our laws declared subject to quarantine, and these are: yellow fever, cholera, typhus, and small-pox, with the very indefinite addition of "any new disease not now known, of a contagious, infectious, or pestilential nature." Scarlet-fever, typhoid, nay, even the "spotted-plague" itself (which is even now occasionally seen in Egypt), not being "new diseases," are excluded from the category, and may be imported free of duty.

The precise mode of propagation of yellow fever is still unknown. It seems, however, to be more frequently transmitted by means of fomites than by personal intercourse. The very laborious investigations of Dr. Chervin in the early part of the present century induced him to absolutely deny the contagiousness of this disease, and Dr. McKinnell vainly attempted to inoculate himself and others with the excretions of yellow fever patients. According to Dr. Richardson, of London, who has given most careful study to the subject of contagion, the poison of yellow fever, with those of cholera and typhoid, "may be called, specifically, the poisons of sewage. They are poisons which enter the body only by being swallowed." Although this statement is perhaps somewhat too exclusive, experience seems to show that the virus of yellow fever is not volatile enough to be carried any distance by the air—that, in the popular sense of the word, it is one of the least contagious of the contagious disorders. Hence, if proper attention be given to disinfecting the excretions of the sick, and all substances with which they have come in contact, little fear need be entertained of the extension of the malady even to those who live in its near neighborhood. The stage at which the poison of yellow fever begins to be generated, and its period of incubation, are also matters of uncertainty. The latter has been fixed by different observers at from two to fifteen days, Dr. Woodward even holding that "in certain cases, the disease may be delayed as long as three weeks after exposure." These differences are accounted for by Aitken on the theory that "the period of incubation tends to lengthen with the transportation and propagation of the disease into latitudes the most remote from the equator." Of course, our quarantine of observation should embrace the maxi-

num period of supposed latency, as applied to passengers and crew; but there is no need of deferring the disinfection of a vessel and cargo for the same length of time. We have, besides, the consolation of knowing that, save in exceptional seasons, the probabilities of yellow fever gaining a foothold in our climate are few. A very moderate degree of cold suffices to destroy it, and it ends about where typhus begins. In a table given by Dr. Motard, under date of 1868, it is shown that of 196 recorded epidemics of yellow fever, 106 occurred between the equator and the 30th degree north latitude; 76 between the 30th and 40th degrees: 13 between the 40th and 50th degrees; only one between the 50th and 60th degrees; and none above the latter parallel.

I shall not weary your patience by referring to the voluminous literature of cholera, further than to state certain general conclusions which are supported by all recorded observations; and these are: That the poison of cholera becomes communicable even in what is known as the "premonitory diarrhœa;" that it resides in the emanations from the bodies of the sick, especially in the intestinal discharges; that it may be dried and thus conveyed as "dust" through the atmosphere for a short distance, resuming its activity when finding the conditions of warmth and moisture in the mucous membranes of a healthy person, but that in the vast majority of instances it is more directly swallowed, and oftenest through the medium of contaminated water; that it may be carried in soiled bedding or other articles; and finally, that, although rendered temporarily inert by intense cold, it may thereby be preserved for a long time, ready to resume its power when restored to a favorable temperature. Its period of incubation in the human system appears to vary from two to eight days. From these data we may readily deduce the precautions to be adopted. A sufficiently wide separation between the sick and well should be made to avoid the possible danger, under certain circumstances, of aerial transmission, although the small risk of this, ordinarily, was shown some years ago by Dr. Sayre's success in confining cholera within narrow limits on board a ship in this harbor with no stronger barrier than a cord drawn across the infected portion of the steerage. The disease is spread by mediate contagion

rather than by direct contact, and, provided that care be exercised to thoroughly disinfect all discharges from the patient and all articles which may have been soiled thereby, its extension can be prevented almost with certainty.

Small-pox, if it were not for the inestimable boon of vaccination, would be a much more difficult foe to vanquish. Its sphere of contagion reaches further than that of any other disease, excepting, perhaps, scarlatina, and its channels of communication are more numerous. Watson says :—"There is no contagion so strong and sure as that of small-pox ; none that operates at so great a distance. . . . It is readily communicable in every way, by inoculation, by breathing a contaminated atmosphere, by the contact or vicinity of fomites. Nay, it may be caught from the dead body." Aitken adds :—"The poisonous material of small-pox is given out from the mucous and cutaneous surfaces of a patient, especially from the lungs and skin, from the exhalations, the secretions, the excretions, the matter in the vesicles and pustules, and the scabs. These all contain the noxious germs of the disease, which may attach themselves to bed-clothes, body-clothes, and especially to woollen, cotton, and felted articles. Such stuffs retain the specific poison for a very long but undetermined period : any number of years as far as is known." And again : "The *infecting distance*, therefore, must be many yards around the patient's person : indeed, with every precaution, there is great difficulty in preventing it spreading from ward to ward in large hospitals during the prevalence of the disease." Richardson holds that the poison "escapes from the surface of the body, in an early stage, as a very fine vapor, and in that way the disease has been communicated Again, the poison may be taken in a fluid form, as we very well know when we spread it by inoculation. . . . In a dry state, as in the scale of a small-pox patient, it is perfectly innocuous, till it comes in contact with water or with the secretions of the body ; then it will become poisonous. Portions of these scales may be wafted into the mouth, where they will be moistened with the secretions of the mouth, and the disease will be produced. . . . We may take the poison of small-pox, grind it down into a powder, and keep it in an almost pure state." The period of incubation of variola averages twelve

days, sometimes extending to fourteen, and there is little doubt that it becomes contagious during the primary fever, although most dangerous during the vesicular and pustular stages. It may be added that by many small-pox is believed to be derived from farcy in the horse.

From these facts it is evident that our most careful precautionary measures may be frustrated by many accidents which it is impossible to foresee. Happily, however, whilst in other contagions our efforts must be confined to preventing their *extension* from the sick, we are enabled in the case of small-pox to avert its *reception* by the healthy; and although no steps should be neglected for the isolation of patients and the disinfection of all things which may convey the poison, our surest reliance must be in the vaccination and revaccination of all unprotected persons.

Whether the poison of typhus can be generated by overcrowding previously healthy persons in a close atmosphere, or whether it is always transmitted by fomites, only awaiting these conditions for its development, is a question still *sub judice*. Many good authorities have entertained the former view, which indeed at one time seemed fully warranted by circumstances; but the events of our recent civil war tend to show its fallacy. Dr. Meredith Clymer affirms the immunity from typhus of both the Federal and Confederate troops, and cites the statement of Dr. Joseph Jones, of Louisiana, that no case of true typhus fever was found by him in any of the Southern military hospitals or prisons, adding that, "if crowd-poisoning were the chief factor in its production, all the elements existed at Andersonville and other prisons in perfection." The fact, nevertheless, faces us that, under its various *aliases* of "jail fever," "ship fever," "spotted fever," etc., typhus has for centuries been associated with crowding and foul air, seeming to justify Richardson's belief that it is produced by "the vaporization of organic matter at a low temperature." This is explained, however, by the stricter contagionists, on the assumption that the specific poison of typhus may be retained by infected substances for an almost indefinite period. Aitken cites numerous observers to prove that the contagion may cling not only to clothing and the like, but even to walls, beams and articles of furniture, and that if fresh air be

excluded, "such articles will retain the poison for a very long time."

But, whatsoever its origin, there can be no doubt that this malady, once established, becomes highly contagious and easily portable by means of fomites. Its poison, which is apparently contained in the exhalations from the lungs and skin of the patient, is communicable only by being inhaled, although, despite its volatility, the sphere of its contagious influence is not very great. Murchison asserts that "if a patient be placed in a large, well-ventilated apartment, the attendants incur little risk, and the other residents in the same house none whatever." Richardson has expressed the more definite opinion that "the poison of typhus fever, which is the most volatile of all, has no power whatever of travelling beyond ten feet from the person affected." Haller, of Vienna, found that the typhus poison was lighter than atmospheric air, having a greater tendency to rise to the upper wards of a hospital or house than to diffuse itself laterally. He also discovered that *dark colored* materials absorb and convey the contagion more readily than lighter ones. Its period of incubation is from a few hours to nine days, according to Murchison, though Aitken (on insufficient evidence, as it seems to me) thinks that it may occasionally be much longer; and its contagiousness is manifested from the appearance of the eruption up to convalescence.

In quarantining this disease, therefore, it is not necessary to separate the sick from the well by very wide distances, nor have we so many channels of transmission to guard as in other maladies. We have only to provide for the destruction of the poison in infected premises and articles, and for this purpose free ventilation will almost alone suffice. Heat, of less high degree than in the case of the other organic poisons, also renders it inert. The inhabited portion of an infected vessel, and all articles which have been directly immersed in a typhus atmosphere, should be thoroughly disinfected, but there is no probability of the contagion extending to merchandise stowed elsewhere. Only under extraordinary circumstances, therefore, is it likely to be necessary in this, or in other quarantinable diseases, to discharge the cargo for the purpose of fumigating the hold, which is entirely separated from the inhabited parts of the ship.

Scarlatina, one of the worst scourges of humanity, and its first cousin, measles, are not quarantinable by our laws, though their tendency to become epidemic should assuredly subject them to all possible sanitary restraint. Both poisons are portable by fomites; both, probably (that of scarlatina certainly), retain their activity for a long period of time. Their stages of latency are longer than those of most other contagia, the incubation of scarlet fever extending from a few hours to ten days, and that of measles as long as sixteen days. Both are contracted chiefly, if not solely, by inhalation, although the apparent conveyance of scarlatina in milk, recently traced in London, may lead to a suspicion of the possibility of this poison being swallowed, whilst the experiments of our countryman, Dr. Salisbury, are cited as proving the inoculability of measles under certain circumstances. You will perhaps remember that during the war Dr. Salisbury found reason to attribute an outbreak of "camp measles" to a peculiar vegetable parasite, which he discovered in the straw on which the affected men had lain. With this fungus he inoculated himself and a few others, all of whom soon afterwards manifested the disease. The obvious source of error in all such experiments, however, is that during the prevalence of a disease of this sort it is impossible to know that one has not been otherwise exposed to contagion. It is only fair to add, that Dr. Kennedy, of Dublin, has seen the fungus described by Dr. Salisbury in linseed meal, by means of which he is confident that measles has been produced. If this be so, the malady in question must be regarded as the only one of its class which can be generated and matured in the vegetable world. At all events, equally careful experiments have demonstrated that measles, as found in the human subject, cannot be inoculated, and that if the chance of breathing its poison be avoided, and its dissemination by fomites prevented, its extension can be controlled. The same remarks apply to scarlatina, in which disease the labors of Dr. Budd, corroborated, I suppose, by the experience of nearly all present, have shown the possibility of confining the contagion within a single room. Of course, in quarantining this malady on a larger scale, we should provide for wide separation of the sick from the susceptible.

To arrive at the general principles which must guide us in

the management of zymotic contagia it is necessary to bear in mind the following data, which seem to be fully sanctioned by observation and experiment:—

All the organic poisons, though needing a certain amount of moisture for their development, are rendered inert by great dilution with water. All may be preserved for a long time if kept perfectly dry, as in infected clothing, etc.

All are destroyed by heat exceeding 212 degrees Fahrenheit; on the other hand, there is reason to believe that all are preservable for an indefinite period in a very low temperature. Between these extremes a certain degree of warmth is necessary for each to manifest its influence, at all events in an epidemic way, yellow fever requiring the highest, and typhus the lowest temperature. The poison of the latter disorder appears to be unable to survive a heat of 100 degrees.

All are also destructible by oxidizing and chemical agents, as ozone, chlorine, iodine, bromine, sulphurous or nitrous acid, carbolic acid, etc.; and, above all, by free ventilation, especially if coupled with plenty of sunlight.

As regards the special groups of poisons; in those which require to be swallowed, we must, besides our general measures of disinfection, have an eye to their peculiar channels of communication, particularly to the contamination of water supply, by which means cholera and typhoid are probably disseminated a hundred fold oftener than in any other way. In the case of the more volatile poisons which are inhaled, we have to guard the lungs of the public instead of its stomach, and for this purpose a distance greater than the utmost reach of infection must be maintained between the sick and the well. In the purely inoculable diseases our precautions are much simplified, although in connection with these I would suggest the possible danger of their conveyance by flies—a mode of contagion which seems clearly proven in the instance of malignant pustule.

Quarantine as at present managed, however, seems to be directed chiefly against fomites which may have been imbued with an organic poison before they were placed on shipboard; and, presumably from this point of view, the rules of our port arrange merchandise in three classes. The first class—comprising “clothing, personal baggage and dunnage, rags, paper rags,

hides, skins, feathers, hair, and all other remains of animals, cotton, hemp, and woollens"—must be "submitted to an obligatory quarantine and to purification." Of these, infected personal clothing and effects are of course by far the most dangerous; rags, from the varied and suspicious sources of their collection, come next; and hides may perhaps have been taken from diseased animals.^a The other articles enumerated, although undoubtedly capable of conveying contagion, provided that they have been placed in a position to absorb it, do not commonly fulfil the latter condition. Except among our American aborigines, fur and feathers are not usually worn by persons suffering from quarantinable disease,^a and it is, to say the least, extremely unlikely that these, or cotton or woollen goods, as packed for consignment to merchants here, could have been exposed to the exhalations of typhus, or soiled by the excreta of patients with cholera or small-pox at their place of departure.

The second class, which is subject to an "optional quarantine," embraces "sugar, silks and linen, and cattle." The latter should, of course, be not only quarantined but destroyed if they bear the seeds of any epizootic malady. To silks and linen fabrics, in commerce, the same reasoning applies as to cotton and woollen goods. With regard to sugar, I can find but one instance recorded which could cause the remotest suspicion of its serving as a vehicle of contagion, and this is in connection with the introduction of yellow fever into the French port of St. Nazaire in the summer of 1861, when we are told that of seventeen men who were engaged to unload a cargo of cases of sugar from the "Anne Marie"—a vessel on which nine of the crew had sickened and two died of yellow fever during the voyage—twelve or thirteen contracted the disease. As these men were at work on board the infected vessel for eight days, however, in the midst of other means of contagion, it is easy to explain their seizure without reference to the sugar, and I think it may safely be assumed that this substance is innocent of spreading any disease more terrible than "grocer's itch."

As an offset to the excessive rigor practised in one direction, a very decided source of danger is frequently overlooked, and this is in floating articles thrown overboard from infected vessels and left to drift within the reach of those who may carry them home

for use. All such things should be picked up and destroyed at once by boat crews employed for this special purpose.

To sum up, the practical points to which I have endeavored to call your attention are these :

I. Communicable zymotic diseases depend upon material organic poisons, and although some of them (as plague, cholera, etc.), may appear to be endemic in certain localities, it is probable that they exist there only by the retention and recrudescence of their specific contagion ; it is almost certain, at all events, that they do not arise spontaneously elsewhere.

II. "Quarantine of observation" should in all instances apply to living beings in whom contagion may remain latent, rather than to inanimate substances which may be disinfected at once.

III. Preventive measures should be adapted to the respective modes of contagion of the several disorders, stricter isolation being necessary in the case of those poisons which are volatile enough to be conveyed in the air, or in vapor of water, than with those which are transmissible only by solid or liquid media.

In conclusion, it only remains for me to acknowledge my obligation to the writings of Aitken, Richardson, Parkes, Hirsch-Simon, Watson, Murchison, Snow, Budd, Fauvel, Motard, Netten, Radcliffe, Burdon-Sanderson, Timothy Lewis, Harris, Woodward, Hallier, and others, to whom I am indebted, directly or at second-hand, for most of the information on which this paper is based.

In the discussion which followed the reading of the foregoing paper,—

Dr. John C. Peters regarded as important the point made by Dr. Carroll, that not only might fomites, such as mattresses, etc., thrown overboard from infected vessels lying in harbor, communicate disease by being washed ashore, but the very water about the vessels might be rendered poisonous from the excrementitious and other filth they were constantly pouring into it. A notable example of this was seen in Gravesend Bay, in 1856. This bay had so sluggish a tidal current that it was little better than a pond, and it was so shallow that the sun could act upon it with powerful effect. Some seventy yellow fever ships lay there contaminating its waters ; and Dr. Walser had remarked, at a recent meeting of the Academy, that persons bathing near these vessels were observed to take the fever much more readily than those employed on their decks. He had attributed this to a miasm emanating from the vessels ; but it seemed very probable that the true solution was the one suggested by Dr. Carroll. Such soluble material thrown up on a sloping shore, like that of Governor's Island, where it

is washed by Buttermilk Channel, could not be collected and burned, as might the beds and boxes cast overboard, but would remain to do its fatal work.

The speaker thought that a reason, perhaps sufficient, why typhus did not prevail in Andersonville and other Southern prisons during the late war, as noted in the paper, might be found in the fact that, although the men were closely crowded, yet it was not as a rule in close buildings; indeed, they had often quite insufficient shelter, and thus a chief condition of crowd-poisoning was wanting.

He had the strongest faith in thorough disinfection. Even the small-pox poison could, no doubt, be completely destroyed by it, so as to prevent the spread of the disease from a given focus, though the people around were not protected by vaccination. But of course it would not be justifiable to neglect this protection.

Dr. Max Herzog thought that the period of incubation of cholera was beyond question, sometimes as long as twenty-two days. Pettenkofer had told him that while he believed theoretically in the quarantining of cholera vessels, yet practically he had never seen the progress of the disease arrested by this measure—doubtless because all quarantines were imperfect. The case of the Atlanta was a most instructive one. There Dr. Sayre had instituted and enforced the strictest quarantine regulations; yet, about a fortnight after the vessel's arrival here, a limited epidemic of cholera broke out on Ward's Island. It was conveyed thither by a nurse, sent to the Ward's Island hospital for a sore foot, having at the time the premonitory diarrhœa, and coming down with the disease soon after.

Dr. Sayre remembered well the heavy censure heaped upon his head in 1856, when, in the case just mentioned, he had acted upon the idea that cholera was communicable. At that time the New York Academy of Medicine, together with other learned professional bodies, the Citizens' Association, and the mercantile interest generally, had proved to their own satisfaction that this notion was an absurdity; that the disease depended wholly upon atmospheric influence, and reached us in great aerial waves against which it was preposterous to dream of erecting barriers. The Board of Health of Providence, and an assembly of Boston physicians, thought it necessary to pass resolutions condemning his unprecedented act in quarantining the vessel. Thank God! the community, lay as well as medical had now learned better.

What especially struck the speaker, in first examining the Atlanta, was that the disease was confined to the fore part of the long, narrow space between decks. The thirty or forty deaths which had already occurred had all been at this end. This puzzled him, for the space was continuous; its atmosphere seemed about equally offensive in every part, and the men and women were piled, like cordwood, in tier on tier of rough, filthy bunks, from end to end. Close inquiry discovered that the fatal cases had been chiefly among those lying next to the forward water-closet, while neither of the other two water-closets on the same deck appeared to have bred any trouble. Following the hint of this definite localization, he cleared out a space, say ten feet wide, across the deck; filled it with pans of carbolic acid; stretched a rope across, and forbade all communication between the two ends of the ship. Slight as this barrier would seem, it proved sufficient, and during the time the passengers remained aboard, not a case of cholera occurred aft of the *cordon sanitaire*. Besides this, the suspected water-closet was shut up, and all excretions were received into a couple of huge copper kettles, impressed for this service, and partially filled with water covered with an inch or two of oil; they were disinfected, beneath the oil, with carbolic acid, and then thrown overboard. The oil was used at the suggestion of Dr. Rich, that if a layer of it in the neck of a wine-flask would preserve its contents indefinitely, the same means might prevent the escape of any poisonous emanations from the discharges. Listening to the remarks of Dr. Peters, it had occurred to him that this disinfection of the discharges was, perhaps, one reason why the disease did not spread from the Atlanta by infecting the water about her.

This instance proved that a perfect quarantine would stop the cholera. Indeed, if that man had not been allowed to leave the ship, contrary to the speaker's orders, we might not then have had a case of it ashore. Armed with these facts, he had gone to Washington to get a law passed establishing a national quarantine—for, as justly remarked by Dr. Carroll, a merely local quarantine was ridiculous; the enemy could at any time evade our guards in front, and steal in by the back door. Such a law might probably have been carried, but for the opposition of the President of the Academy of Medicine, backed up by the whole profession of the city. The most practical plan for quarantine which he had seen was that put forward by Dr. Marsden, of Quebec. If faithfully enforced it would certainly prove efficient, while it would not hinder commerce, but facilitate it. He entirely agreed with Dr. Carroll's views, and wished that he had added to his paper a practical scheme of quarantine legislation.

Dr. Elisha Harris was not surprised that the facts in the Atlanta's case should so have impressed Dr. Sayre. Even a year earlier, in 1855, he had himself been led to conclude that cholera was portable from country to country. If Dr. Sayre had allowed those emigrants to go at large through the city, we should probably have had a general epidemic here, instead of the local one confined to Ward's Island—for there were no cases off the Island until the 30th of April following. Though we might perhaps admit, with Pettenkofer, that after cholera is fairly planted on our shores, commerce and travel have such interests as to necessitate our incurring a certain amount of risk, yet certainly, before it is so planted, we should sustain every effort, like Dr. Sayre's, to prevent the introduction of its first germs.

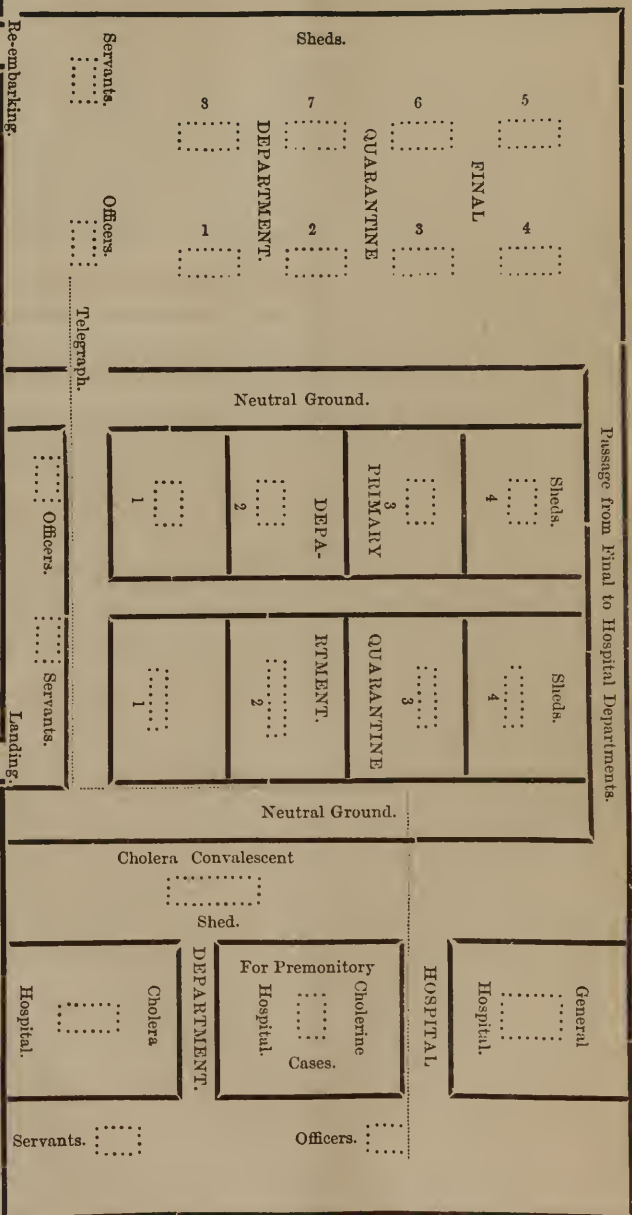
As to yellow fever, the ground taken by Dr. Carroll seemed pretty clearly proved—that it is not conveyable by persons, if rigid care is taken to exclude the chance of their carrying its germs about them in fomites. The speaker agreed, therefore, that a personal quarantine in this disease appeared unnecessary. It was evident there was the greatest necessity for a thorough remodelling of our quarantine system. Why, for instance, should coffee—an article which has never been known to convey yellow fever—be placed under ban, unless to enrich certain officials by the charges for disinfection and lightage?

A competent commission of medical men should be either officially appointed, or else selected by the profession of this city, and be set to study these questions, with reference to directing legislation upon them. It would not be difficult to name a commission which would inspire confidence that we should be both more thoroughly protected from the invasion of exotic diseases, and at the same time freed from the most vexatious, because useless, inconveniences of the present system.

Meanwhile, let us disinfect. Though we may not know what the disease-germs are, we do know that disinfectants will destroy them. Dr. Wm. Budd had, for the last eighteen years, had no spread of scarlatina in his private practice, but had been able to confine it to the room in which it originated. In the city of Bristol, though badly built from a sanitarian point of view, both scarlatina and small-pox had, for several years, been held under control; and the people had come to understand this and expect it. They had there the advantage of a body of trained and paid women, who, as far back as 1866, were employed to go from house to house, explain in detail the processes of disinfection, and see them thoroughly carried out. The fruits of this labor had taught all classes to trust the sanitary authorities, and heartily second their efforts.

DR. MARSDEN'S PLAN OF CHOLERA QUARANTINE STATION.

Passage from Final to Hospital Departments.



RIVER

FRONT

[Through the great kindness of my friend, Professor Lewis A. Sayre, I am enabled to append the plan of cholera quarantine devised by Dr. Marsden, of Quebec, which, for simplicity and efficiency, is certainly far in advance of any other scheme hitherto suggested. As will be seen, it does not involve hindrance to commerce, but applies to persons and personal effects. A similar plan, with certain modifications, might be adapted to the management of other quarantinable diseases.]

Dr. Marsden's Plan for a Cholera Quarantine Station.

1. The Cholera Quarantine Station shall be divided into three separate and distinct sections or departments.

2. Each of these three sections or departments shall be isolated and separated from one another, by a *cordon* or portion of neutral ground, of not less than one hundred feet wide.*

a. One of these sections or departments, shall be appropriated to the use of the sick, and shall be the Hospital Department.

b. The next, or Central Section or Department, shall be devoted to the use of passengers not having had cholera, but from infected vessels.

c. And the third, or healthy section or department, shall be appropriated to the use of the healthy, who have been removed from the Central Department, after having performed quarantine there.

A. In the first section or department, there shall be three separate and distinct hospitals, besides a convalescent shed or hospital.

a. The one for confirmed cases of cholera to be called the Cholera Hospital.

b. Another for cases of choleraic diarrhœa, or other premonitory symptoms of cholera, to be called the Hospital for Cholerine.

c. The third, for all other diseases, not cholera or cholerine, but coming from on board infected vessels, or vessels having had cholera on board, to be called the General Hospital.

B. The next, or central section or department, shall be the Primary Quarantine Department, and shall be appropriated to all persons who are not sick, but come from vessels having had cholera on board, and wherein every case on landing shall undergo inspection, washing, cleansing, and purifying, both of persons and personal effects. There a quarantine of four days shall be performed, at the end of which period of time all such persons as continue in sound health shall be removed to the Final Quarantine Department, and any that may fall sick, or be threatened with sickness during the four days of probation shall, as soon as detected, be removed to the proper hospital, in the Hospital Department. There, also, the healthy inmates shall be removed daily to a new locality, thus occupying four different habitations during their sojourn.

C. The third, or healthy department, shall be the Final Department, and shall be for all cases coming from the Primary Quarantine Department, after having been washed, cleansed, and disinfected, and after having undergone the *four days* quarantine; and here a further quarantine of *six* days shall be performed, (except cases coming from the convalescent hospital or shed, hereinafter provided for) making in all *ten days* of quarantine, when all persons continuing healthy shall be discharged from quarantine, and be removed from the station. If any premonitory symptoms, or other cases of sickness occur in this department, during the six days of quarantine, they shall, as soon as discovered, be removed to the proper hospital, in the Hospital Department.

No communication shall take place with the Hospital Department

* I am of opinion that less than this space might suffice

except through the central or Primary Quarantine Department, for which purpose a passage, unfrequented by the persons undergoing quarantine, shall be set aside and reserved. The three sections or departments above described, shall be designated and known as—

1. The Hospital Department.
2. The Primary Quarantine Department.
3. The Final Quarantine Department.

TO PILOTS.

1. All vessels coming from infected ports, and having, or having had, cholera cases on board, shall be brought to anchor abreast of the central or Primary Quarantine Department or station.

2. All vessels coming from ports known to be infected by cholera, or not, and not having, or having had, any case or cases of cholera on board, shall be brought to anchor abreast of the healthy or Final Quarantine Department or station, where and when they shall be boarded by the medical officer of that Department, and he shall have power either to discharge them from Quarantine forthwith, or detain them, if he finds sufficient cause for so doing.

ON LANDING AND RE-EMBARKING.

a. The landing of passengers and their effects shall take place at the Primary Quarantine Department *only*.

b. The re-embarking of passengers and their effects shall take place from the Final Quarantine Department *only*.

1. On the landing of passengers from on board ships at the Primary Quarantine Station, the sick shall be forthwith removed to the Hospital Department, and the healthy to the place assigned to them in the Primary Quarantine Department.

2. The sick shall be borne upon litters and placed within the neutral limits about midway between the Primary Quarantine and Hospital Departments, by the persons who bring them ashore, and who shall then retire to the Primary Quarantine Department (unless they be seamen belonging to the vessel, in which case they shall return aboard ship); whereupon, persons from the Hospital Department shall enter the neutral ground, and remove them to the proper hospital.

3. There shall be in the Hospital Department, at a reasonable distance from the Cholera Hospital, a shed or building for cholera convalescents, where they shall remain at least *four days* previous to being removed to the Primary Quarantine Department, and where a quarantine of *four more days* shall be performed, after cleansing, washing, and purifying, previous to removal to the Final Quarantine Department, where *two more days* of quarantine only, instead of six, shall be performed, making in all *ten clear days* after leaving the Cholera Hospital, when, if the patient continues healthy, he or she shall be discharged.

4. Persons having completed their period of quarantine, shall be removed at once from the Quarantine Station, by steamers chartered for the purpose, and shall proceed directly on their journey.

5. Provisions, stores, clothing, bedding, and all other necessities or supplies for the Hospital Department, shall be conveyed within the Hospital limits under the same regulations and restrictions as persons.

6. All physicians, orderlies, nurses, servants, attendants, etc., connected with the Cholera Quarantine Station, as also all persons performing quarantine, shall remain, and be kept constantly in the department or section to which they have been respectively assigned, and none of them shall, under any pretext whatever, be permitted to have any communication or intercourse whatever, directly or indirectly, with persons from another department or section, excepting in due course of quarantine.

7. Any employee, nurse, or orderly belonging to the Quarantine Station, who may be found violating the above rule, shall be liable to suspension from office, with forfeiture of salary and emoluments, or dismissal from office, at the discretion of the medical officer in charge, or of the Superin-

tendent, besides being obliged to undergo such quarantine as the nature of the contact or exposure may warrant.

8. Any person violating the above rule by going from the Final Quarantine Department to the Primary Quarantine Department, or from either of these to the Hospital Department, shall, on detection, be detained in the Department they have gone into, in violation of the law, and shall undergo quarantine anew.

9. All persons suffering the approach of persons from any Department, excepting in due course of quarantine, will render themselves liable, at the discretion of the medical officer, to be sent back to the Department to which the person so approaching them belonged, and shall undergo quarantine anew.

10. The three Quarantine Departments shall be separated from each other, and bounded by a *cordon*, or piece of neutral ground, of at least one hundred feet in width, and shall be surrounded by a strong fence of at least seven feet high.

11. Between the Final Quarantine and Hospital Departments, at the extreme end of the Primary Quarantine Department, there shall be a *cordon*, or passage or portion of ground, of at least thirty feet wide, with a close fence of seven feet high, to be used exclusively as a passage from the Final to the Hospital Department for the return of patients to the Hospital Department, if necessary.

12. Each of the subdivisions in the Hospital Department shall be surrounded by an open fence seven feet high.

13. Each of the subdivisions in the other departments, and especially in the Primary Quarantine Department, shall be surrounded by a close fence seven feet high.

14. Each of the before mentioned departments may be subdivided in such manner as circumstances may require, and as near as practicable in accordance with the accompanying plan.

15. The place of landing, in the Primary Quarantine Department, shall be as near the Hospital Department as convenient, and as far removed as possible from the place of departure or re-embarkation in the Final Quarantine Department.

16. There shall be telegraphic communication between each of the departments, with a telegraph operator attached to each.

Among the additional details of my plan, the following is the most important:

A *perpetual* stream of water shall be made to flow through all the water closets, cess pools, drains, &c., which shall empty themselves at low-water mark; and such other disinfectants and deodorizers as science may suggest and necessity dictate, shall also be used.

W. MARSDEN, M.D.,

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Hon. Fel. Mont. Pathological Soc., &c., &c.

PLACE d'ARMES, QUEBEC,
January 10th, 1866.

